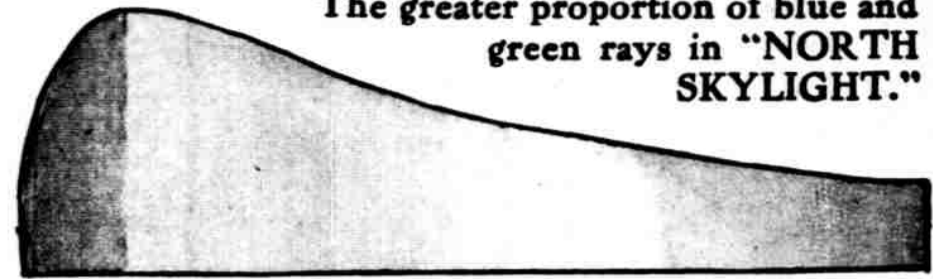
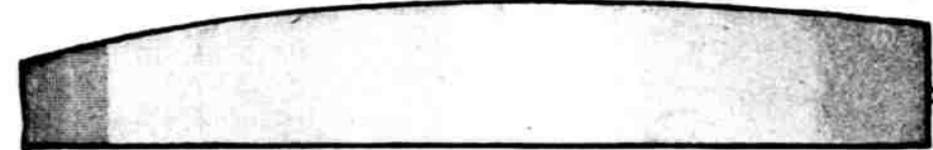


ARTIFICIAL DAYLIGHT DISCOVERED— THREE KINDS OF IT.

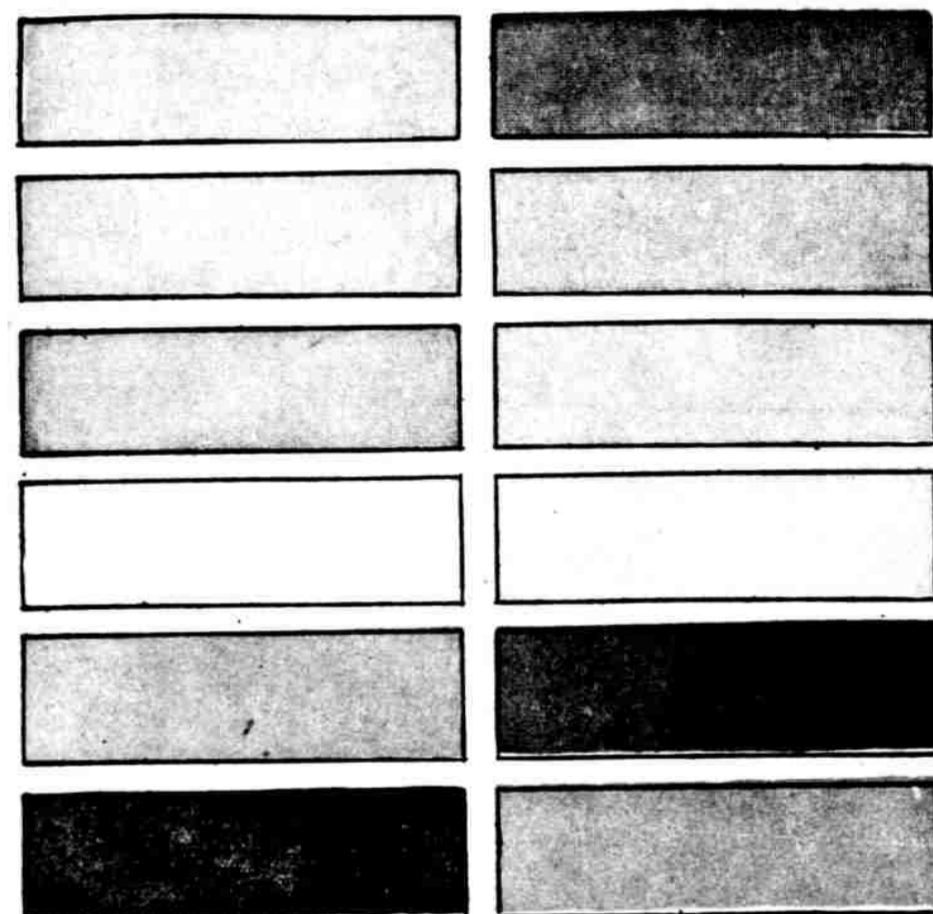
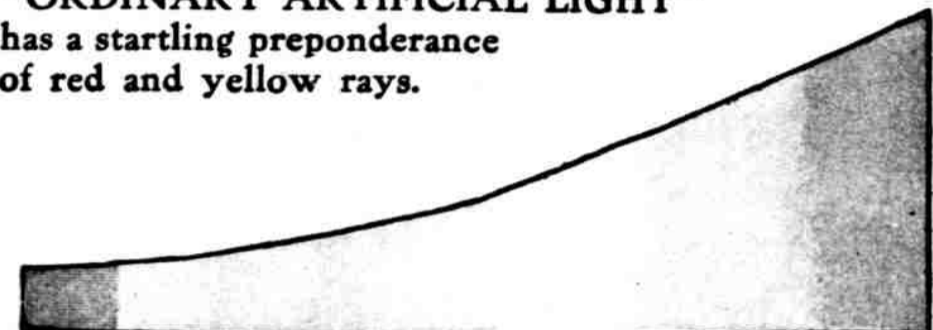
The greater proportion of blue and green rays in "NORTH SKYLIGHT."



"CLEAR NOON SUNLIGHT" has various color rays in almost equal proportions.



"ORDINARY ARTIFICIAL LIGHT" has a startling preponderance of red and yellow rays.



A chart showing the remarkable changes that take place in colors when they are placed under the modern artificial light. The row on the left shows colors as they appear under a normal daylight. The row on the right shows the same colors as they appear under artificial light. It will be seen that under artificial light a maroon becomes a red-orange; blue becomes almost a purple; yellow appears as orange; a pink lavender becomes a rose; a blue-green becomes a yellow-green; and a lighter quality of blue becomes violet.

ARTIFICIAL daylight has been discovered. Lighting has made its way, under the compulsion of the stern and propelling hand of the scientists, from the crude pine torch, through the improved grease and oil lamp and the perfected carbon and other metallic filament lamps to the light which is nothing less than a small sun in itself.

The discovery, or rather the invention, took place at the remarkable laboratories which the National Lamp Works maintain at Nela Park, in East Cleveland. It is the result of a long series of experiments conducted by Dr. M. Luckiesh, the physicist of the laboratories, and it brings to homes, to factories, to offices, in fact to every enclosed space where light is necessary, an illumination which is different from the sun itself only in intensity.

Like many important inventions, this one is comparatively simple in its workings. It consists of the modern Tungsten filament lamp covered with blue-tinted glass. The most difficult part of the invention was the attainment of the exact shade of blue and it took many months to work it out. The light from the lamp in passing through the blue-tinted glass loses its excess of yellow and red rays and gains the necessary blue rays which it lacks. The result is a light which has the exact quality of daylight.

What the discovery means to dry goods stores, to printing establishments, and especially to art and to artists is prodigious. It gives a day of twenty-four hours to those who have to work in colors where before a brief day of but twelve hours at the most was allotted to them.

Strangely enough, Dr. M. Luckiesh, the strict and incorrigible scientist, takes the greatest amount of pleasure in his discovery in the fact that it can do such a vast amount for art. He is interested, naturally, in the lighting of homes and business places where colors are used with artificial daylight, but his chief delight in his discovery is that for the first time in the history of the world it per-

mits of the lighting of masterpieces of art as the artists who made them intended that they should be lighted.

"Admitting at the outset the artist's superior knowledge of the importance of light, shade and color in his creations, it should be of interest to learn how the lighting specialist has studied these same factors in respect to the lighting of art," he says. "As a rule art galleries are very badly lighted. Whether the artist realizes this or not I do not know, but I can state with conviction born with a knowledge of the possibilities in lighting that art is usually badly lighted."

"The artist has often shown a hatred toward science, seemingly under the impression that art goes further than the mere scientific mixing and grouping of colors or shadows and produces effects beyond scientific explanation. This may be true to some extent, but not in the main. By no means do I believe that art is produced by rule of thumb, by scientific formulae or, in other words, that it can be manufactured."

"But scientific explanations can be presented for many of the supposed mysterious effects, and the lighting of a work of art can make or mar it. Incidently I hope the artist will look more kindly upon the lighting specialist—not the so-called illuminating engineer—but the scarier variety, the lighting artist."

"The realm of painting seems to be an especially neglected field so far as lighting is concerned. The artist himself has given little attention to lighting. I do not refer to the problem of lighting art galleries even though this is usually poorly done, but I refer to the individual painting."

"In the first place the artist cannot paint what he sees. Maybe he does not wish to do so, but he even cannot paint what he wishes, owing to a great initial handicap. Imagine a scene in nature. The brightest spot is perhaps 500 times lighter than the darkest area. On a plain canvas the artist cannot produce more than forty times brighter than his darkest pigment."

"At once he is handicapped and no kind of general lighting can reduce this handicap. A local lighting unit, however, can be of great assistance. By placing a local lighting unit in a proper position, so that the lightest part of the painting will receive much more light than the darkest, the range of contrast found in nature can be more nearly produced."

"The mural painting often suffers from artificial lighting when it could often be much benefited. The artist of course has carefully considered its environment, that is, the lighting, the color of its surroundings and its position. This no doubt was done in daylight, but the great difference between natural and artificial lighting is likely to be unsatisfactory."

"To return to the specific painting, it is interesting to consider the effect of the quality or color of the light. The painting has perhaps been executed in daylight. All know the great difference existing between the color values of illuminants. The artist has no doubt carefully harmonized his color scheme both as to colors and values. Pigments, however, owe their color largely to the light falling upon them, therefore change considerably when lighted by an artificial means depending upon the illuminant."

"Not only do the colors change in hue but relative values are very much upset. Experiments also show that by varying the quality or color value of the light, the painting can be made to express many moods. The artist attempts to express but one mood in a picture, therefore he needs the co-operation of the lighting artist in order properly to illuminate the work by artificial light. Red, green and blue lights, when properly controlled by means of dimmers, will produce many qualities of lights and an apparatus of this character should prove of inestimable value to the art student or artist."

"Light is one of the most important factors in the scheme of creation. It is one of the great essentials to life and progress. The activities of primitive man were practically bounded by sunrise and sunset. We can imagine the growing desire for longer hours of activity which resulted in his learning to make fire. By burning solid fuel he produced light as well as heat. Thus we can picture primitive man with his burning pine knot exultant in his victory over nature. Man's

activities were no longer limited to daylight hours and progress really began."

"Many centuries of course elapsed before the grease lamp and wax candle were introduced. Then the tallow candle entered and its use extended until the present time."

"It was only a few years ago that science made any effort to attack the problem of light production in an organized manner. The oil lamp was an early achievement. Then followed the development of gas jets and mantles, and later, reinforced by electrical development, science gave to the world the arc and incandescent lamps."

"With an ever increasing momentum electric incandescent lamps were improved, new filament materials were discovered, and better manufacturing processes were developed, with the result that in rapid succession came the carbon, metallized carbon, tantalum and tungsten filament lamps."

"Recently the incandescent bulb has been filled with a gas which has greatly increased the amount of light. Altogether in the course of a few years the efficiency of light production by incandescent filaments has increased from 5 watts per candle to 5 watt per candle."

"As we look back at any of the early illuminants we might sincerely feel

"'Twas light that made
Darkness itself appear
A thing of comfort."

"But each illuminant has served its purpose if for no other reason than that it was an improvement—a victory. The pine knot served the primitive needs of our early ancestors. Their activities were limited. Few arts had been developed or even begun. A light source of the simplest kind freed these early beings from the shackles of night and to these primitive victory was complete. Today, however, owing to our complex activities, there is a real need for good lighting. In many arts there is a demand for a complete substitute for daylight, that is for artificial daylight."

"Daylight hours are insufficient for modern manufacturing methods and in our congested, smoky cities massed with skyscrapers even daylight hours are much shortened and in many cases are practically extinct. Thus our activities of today demand proper lighting and out of this demand has risen the lighting expert. 'The beginning of the present century marks the advent of the art and science of illumination. Rapid strides have been made in the study and practice of lighting. The prime object of scientific illumination is conservation, that is, the saving of eyesight, time and materials.'"

"The quality of light was one of the first problems that Dr. Luckiesh and other modern lighting experts attacked."

"Arts and crafts involving the use of color have been standardized in daylight. Color vision has evolved under nature's lighting, and as vision is exercised many hours a day in natural light the appearance of colors under daylight illumination has become standard. In other words the color values of artificial illuminants are quite accidental but the quality of daylight is a part of the scheme of creation."

"According to the latest knowledge," continues Dr. Luckiesh, "light consists of electromagnetic waves not very unlike those used in wireless telegraphy. These are radiated from an incandescent light source at many different frequencies or wave lengths. The eye, like a wireless receiving station, is tuned to perceive only a narrow range of wave-lengths. Energy of different wave lengths is perceived as different colors. When these different impulses impinge upon the retina of the eye separately the various color sensations are experienced as in viewing the rainbow."

"When a portion of the retina receives them all simultaneously, as in the case when a white paper illuminated by sunlight is viewed, a sensation of white light is experienced. We see objects usually by reflected light. A red paper appears red because it has the ability to reflect only the red rays and to absorb the light energy of other wave lengths."

"This is simply a characteristic of the chemical compound used in 'coloring' the paper. Illuminate the red paper with a blue or green light and it appears black. If the paper had never been seen under any other light except green or blue it would not have been named a red paper."

"In other words the color of an object depends upon the quality or color-value of the illuminant. No colored object can appear the same under two different il-

luminants. Further, ordinary colors are often so composite that two may appear alike under one illuminant and widely different when illuminated from another source."

"With these facts in mind scientists attacked the problem of an artificial daylight. Now daylight varies considerably, owing to clouds, smoke and reflections from colored surroundings, such as trees and buildings, so that it is necessary to establish a standard before attempting to produce artificial daylight. In the Nela research laboratory several years ago measurements were made of the quality or spectral character of daylight. These were combined with measurements made in different parts of the world and an average noon sunlight and an average north blue skylight were established."

"Any phase of daylight contains rays of all wave lengths or colors. Therefore a light source in order to be chosen for the purpose of producing artificial daylight must likewise have all the rays present. What Luckiesh and his helpers did was to proceed to eliminate the excess of yellow, orange and red rays by means of a properly colored glass which subdues these rays to the proper proportions."

"This was accomplished largely by the results of experiments made in the Nela research laboratories looking toward the development of a colored glass which when used with the latest and best incandescent lamp would give light of a daylight quality. Three classes of this glass have been developed."

"North skylight has been produced for the purpose of accurate color matching. It is not intended for general lighting but is designed for use over work tables where colors must be matched and mixed with accuracy."

"Light of an average noon sunlight quality is produced for general lighting. In lithography and other color printing plants, light of this quality is produced with the new gas filled lamp in large sizes at nearly the same efficiency as that at which the older types of lamp are operated."

"The third kind of daylight produced is that which corresponds to afternoon sunlight. This light is of a better quality than that of any unaltered light source. The colored glass is mixed or coated with white opal glass for decorative purposes."

